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MASKED SEARCH PROGRAM

TECHNICAL DOCUMENTARY REPORT NO. ESD-TDR-64-629

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G. S. Stoller

Prepared for

DIRECTORATE OF COMPUTERS
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND

UNITED STATES AIR FORCE

L. G. Hanscom Field, Bedford, Massachusetts

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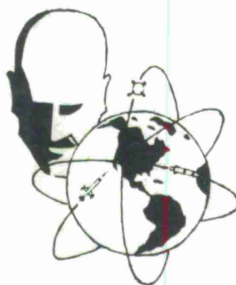
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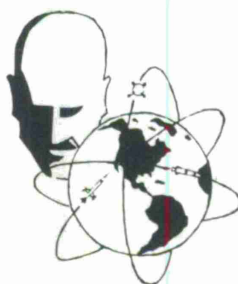
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ABSTRACT

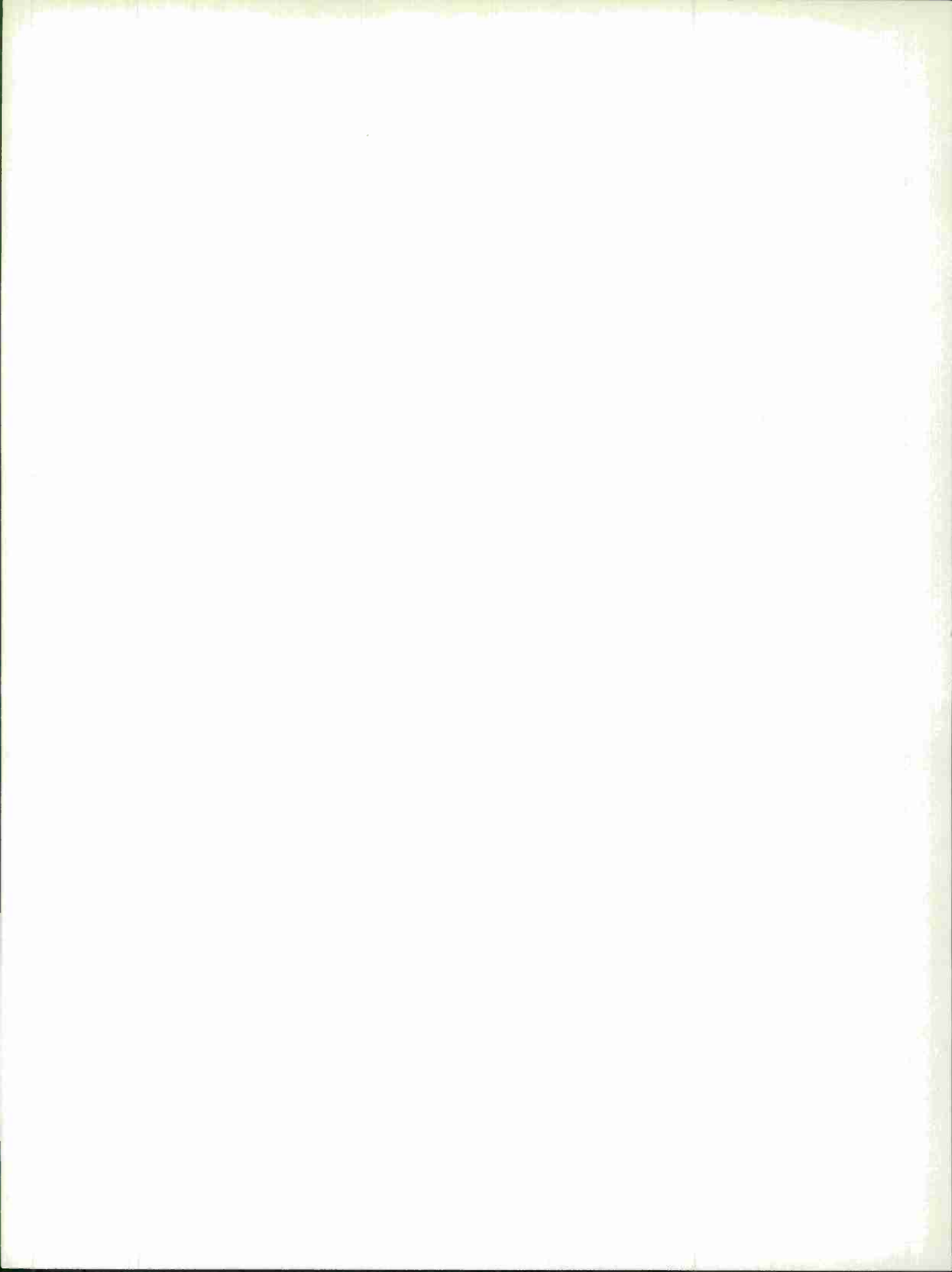
The Masked Search Program is a static trace and can be used for debugging or modifying a 7090 program. This report describes the program and how it is used in most cases. Additional information is provided to cover unusual occurrences during the program run.

REVIEW AND APPROVAL

This technical documentary report has been reviewed and is approved.



JOHN F. EGAN
Project Officer



MASKED SEARCH PROGRAM

SECTION I

INTRODUCTION

Sections II through VI of this document describe the Masked Search Program and how it is used for most cases. Sections VII through XII provide additional information to cover an unusual occurrence during the running of the program. Sections VII through XII are also useful for changing the program for a non-M90 run or for running the program with a different monitor system. For example, any tape unit can be chosen as the input tape and any other tape unit may be designated as the output tape. The input tape can be prepared by a peripheral card-to-tape unit and the output tape can be listed on a peripheral tape-to-printer unit.

SECTION II

PURPOSE OF PROGRAM

By means of specification cards (described in Section IV), the user specifies a mask and a search area (block of storage) to the program. In accordance with the specification request, the program prints out a list of the locations in the search area that satisfy the conditions set up by the specification cards.

For instance, an address mask may be used to find all locations that have anything to do with a particular entry point to a subroutine; i. e., from which locations is this subroutine entered? After obtaining a list of the locations having this entry point as their address, a listing of the data being searched would normally tell where in the search area this subroutine is being entered.

Another example involves finding how certain storage locations are used; i. e., what is stored there and when is it read? * By means of an op-code mask, one can find all locations that contain instructions which change memory, i. e., all "store" instructions and RDS.

* This routine is a tool that was used to change a large system program (the META assembler) which was the working program.

SECTION III

DIRECTIONS FOR USE OF MASKED SEARCH PROGRAM

The Masked Search Program uses a relocatable column-binary deck. This deck should be preceded by a "relocate origin" card when it is being loaded. This card will have a 7-9 punch in column 1. The origin at which the Masked Search Program is to be loaded into the memory will be specified in the address field of what is usually the checksum word (the bottom three rows of column 5 and all of column 6).

The Masked Search Program can be loaded using the M90 load card. Along with the Masked Search Program, one should load the data that is to be searched.

After the loading is completed, control is given to the Masked Search Program. The program expects to find the specification cards on the community input (COMIN) tape. The specification cards should be BCD cards stored one-per-record (in BCD records) on the COMIN tape. If redundancy or EOF is encountered while attempting to read a specification card, the program aborts.

All output is written on the community output (COMOUT) tape for offline printing.

The deck for a sample run using the Masked Search Program could be arranged as follows:

III JOB

III LOAD 2COMIN

binary deck of program to be searched

"relocate origin" card

binary deck of Masked Search Program

III 1401 DATA, 1

input specification cards for the search

III ENDJOB

It is assumed that the program to be search contains exactly one transfer card. The number of transfer cards in that program determines the coefficient of "COMIN" on the M90 LOAD card.

The Masked Search Program occupies 224_{10} (340_8) locations of which the last 24_{10} (30_8) are buffer locations. For this reason it is restricted to be loaded with a new origin between 6_8 and 70470_8 .

SECTION IV

FORMAT OF (INPUT) SPECIFICATION CARDS

The first two columns of a specification card contain characters which tell the program what function to perform. Six functions are provided and can be called for by using the characters EQ, RL, RA, BD, MK, HO.

Following the characters which request a function are two fields each containing an octal integer (possibly signed). Both fields are required on the RL, RA, and BD cards. Only the first field is required on the EQ and MK cards. No fields are required on the HO card. The terms "argument 1" and "argument 2" shall refer to the contents of the first and second fields of a specification card (respectively).

Each of these two fields begins at a fixed length and a fixed column. The first field begins at column 6 and extends through column 18. The second field begins at column 24 and extends through column 36. Thus each field occupies 13 columns. In each field, the low-order 12 columns are interpreted as though each contained an octal digit. That is, only the three low-order bits of the six-bit character code are used when interpreting these columns. Hence, a blank column is equivalent to a column with a 0 punched in it. The first column of each field (columns 6 and 24) is examined for a minus sign. If this column contains a minus sign, then the corresponding argument is made negative through an SSM instruction. If this column does not contain a minus sign, the corresponding argument is unchanged.

Beyond the required columns, all punches are ignored. Hence comments may be inserted on all specification cards after column 37.

The EQ card (equals) causes the program to investigate the search area for words which are identical to argument 1 of the EQ card when looked at through the mask. The locations of these words are printed out (offline).

The RL card (range, logical) is used for a range search on logical quantities (i.e., unsigned numbers from 0 to $2^{36}-1$). Here the sign bits of the arguments are considered as numerical bits. The program examines the search area for words which, considered as logical quantities, lie between (logical) argument 1 and (logical) argument 2 inclusive, when all of these quantities are looked at through the mask. The locations of these words are printed out (offline).

The RA card (range algebraic) causes the same processing as an RL card except that here the comparisons are algebraic (i.e., signed).

The BD card sets boundaries for the search area. Argument 1 is the first-word location and argument 2 is one more than the last-word location. These two arguments are not masked. A search area consisting of more than 77776_8 locations should not be used. The addresses set by a BD card are initialized to the values that they would contain if a BD card having 0_8 as argument 1 and 77776_8 as argument 2 had been read in.

Argument 1 of the MK card (mask) is a mask which will be used on all subsequent searches until overridden by another MK card. Obviously this argument is not masked by the present mask. An initial mask of "all ones" is assumed.

The HO card (whoa) terminates the reading of specification cards. Its fields are ignored. A normal return to the monitor results after this card is read.

SECTION V

FORMAT OF COMMENT CARDS

A card that has been read into the computer by this program is considered a comment card only if column 2 is blank. Column 1 is then assumed to contain a carriage-control character for the printer. (Use a blank in column 1 if you wish to single space when printing this card; i.e., print on the line now available and then space up once.)

SECTION VI

OUTPUT FORMAT

All input cards (specification cards and comments cards) will be printed out (offline). The card will be printed basically as it is punched; i.e., characters in adjoining columns will be printed in adjoining print positions. The only exceptions to this rule are columns 1 and 2 which will be offset to the left.

Program-generated data will be printed out immediately after the specification card that caused it. If a specification card's conditions are not met anywhere in the search area, the line following the one on which the specification card was printed will be blank.

SECTION VII

ERROR RETURNS TO MONITOR

There are two conditions that cause a return to the error-entry point of the monitor. One of these is a format error on an input card; i.e., column 2 is not blank and none of the acceptable identifying characters, namely EQ, RL, RA, BD, MK, HO, have been found in columns 1 and 2. An EOF redundancy encountered while attempting to read a specification card (from COMIN) is the other error condition.

When an error occurs, the program either drops into or transfers to an expansion of the macro BAH. This macro expansion consists of the following two instructions:

```
-0 62500 0 00305 STL LCTN
```

```
0 02000 0 00003 TRA ERRPRT
```

The address portion of the symbolic location LCTN, which is at nominal location 305₈, shows the actual location at which the error was made known. From this, the nominal location at which the error was made known may be computed. The comment appearing on the BAH card that is found near this nominal location in the attached listing will identify the error.

In the dump that is given, all of memory and all of the central processor's registers will be shown exactly as they were at the time that the error was made known, except for the accumulator and the MQ. (Memory locations LCTN and ERRPRT+2 may also be changed, but this is expected, and the previous contents of these registers are not needed for any debugging.)

SECTION VIII

ADDITIONAL NOTES ON (INPUT) SPECIFICATION CARDS

For both range searches (RL and RA), if argument 1 is identical to argument 2 when both are looked at through the mask, the program goes to the EQ routine. This is indicated in the printout on the line printed out immediately after the line on which the specification card was printed. In this situation, the line will always be printed out; a blank line will be printed if no program-generated data is available. If some program-generated data is to be printed out, then this line will be indented 12 print positions over its usual indentation. (Program-generated data is usually indented six print positions. The first digit of program-generated data to be printed on a line usually occupies print position 8.)

Optimization (of time-expenditure) in a range search may be possible if one has some knowledge of the data to be search. The first comparison against an argument will be made against argument 1, and if this comparison shows that the word cannot lie between argument 1 and argument 2 (when all are masked) no comparison against argument 2 is made. There is no "size" or "magnitude" ordering inherent in the arguments. (The program compares them to find out which is the greater of the two arguments.) That is, argument 1 can be less than, equal to, or greater than argument 2 when both are looked at through the mask. This allows the search to be optimized, as in the following two cases. If one is looking for all memory references to a block of storage which is near the end of his program, then he should choose the first-word location of that block as argument 1 and the last-word location of that block as argument 2. However, if this block lies near the beginning

of his program, then he should choose the last-word location of that block as argument 1 and the first-word location of that block as argument 2. Naturally, an address mask is used.

SECTION IX

ADDITIONAL NOTES ON OUTPUT FORMAT

A comment card is printed out which looks nearly the way it did when it was read in. Column 1 of the card was used as a carriage-control character. The character that appeared in column 3 is printed in print position 9, column 4 is printed in print position 10, and so on for the other columns, ending with column 80 being printed in print position 86.

A specification card is printed in a similar fashion. First, a carriage-control character is inserted in the line to cause the printer to space up two lines before printing the specification card. Columns 1 and 2 of the specification card are printed in print positions 3 and 4, respectively, column 3 is printed in print position 9, column 4 is printed in print position 10 and so on, ending with column 80 being printed in print position 86.

If there is an error in the format of an input card, this card is not printed out and the program goes to its error exit. Hence, the last input card printed is the one that appeared just before the card that is in error.

The buffer size for program-generated output is 22 words. The first word is a word of blanks. At most, 21 words of program-generated output are printed per line. In fact, a full line of program-generated data for EQ, RL, and RA output will normally contain 21 locations. An abnormal case occurs when an RL or RA specification card is read in, and arguments 1 and 2 are identical when looked at through the mask. In this case, the first line of program-generated output is indented 12 print positions if there is any program-generated data to be printed out. If no program-generated data exists for this specification card after the search is completed, a blank line is printed out.

SECTION X

DESCRIPTION OF SYMBOLIC DECK

The symbolic deck is sprinkled with comments to aid anyone who sees a need to change it. The notation "C(PLACE)" is to be read "the contents of location PLACE," and "CA(PLACE)" is to be read "the contents of the address field of location "PLACE." The notations "GR(TH1, TH2)," "EQ(TH1, TH2)," "LS(TH1, TH2)" are almost self-explanatory; a full description of these functions can be found in supplement 1 to the META manual (MITRE TM-77 #2, S1).

The symbolic deck is set up to punch a relocatable column-binary deck with nominal origin 0.

This program is dependent upon the regular monitor (i.e., the monitor that is left in main memory after an M90 LOAD card) for its I/O. All parts of this program that are in any way dependent upon the monitor are grouped together near the beginning of the program. (They are contained between card numbers 15 and 50 of the Appendix.)

SECTION XI

DESCRIPTION OF BINARY DECK

The binary deck is a column-binary relocatable deck with nominal origin 0.

Exactly 224_{10} (340_8) locations are required by the Masked Search Program for instructions, constants, and buffers. Only the first 200_{10} (310_8) locations are loaded. In the last 24_{10} locations arguments 1 and 2 are stored, input is read into, and output is written from.

Those parts of the program which are dependent on the monitor occupy nominal locations 1_8 through 23_8 .

SECTION XII

BLOCK DIAGRAM AND LISTING

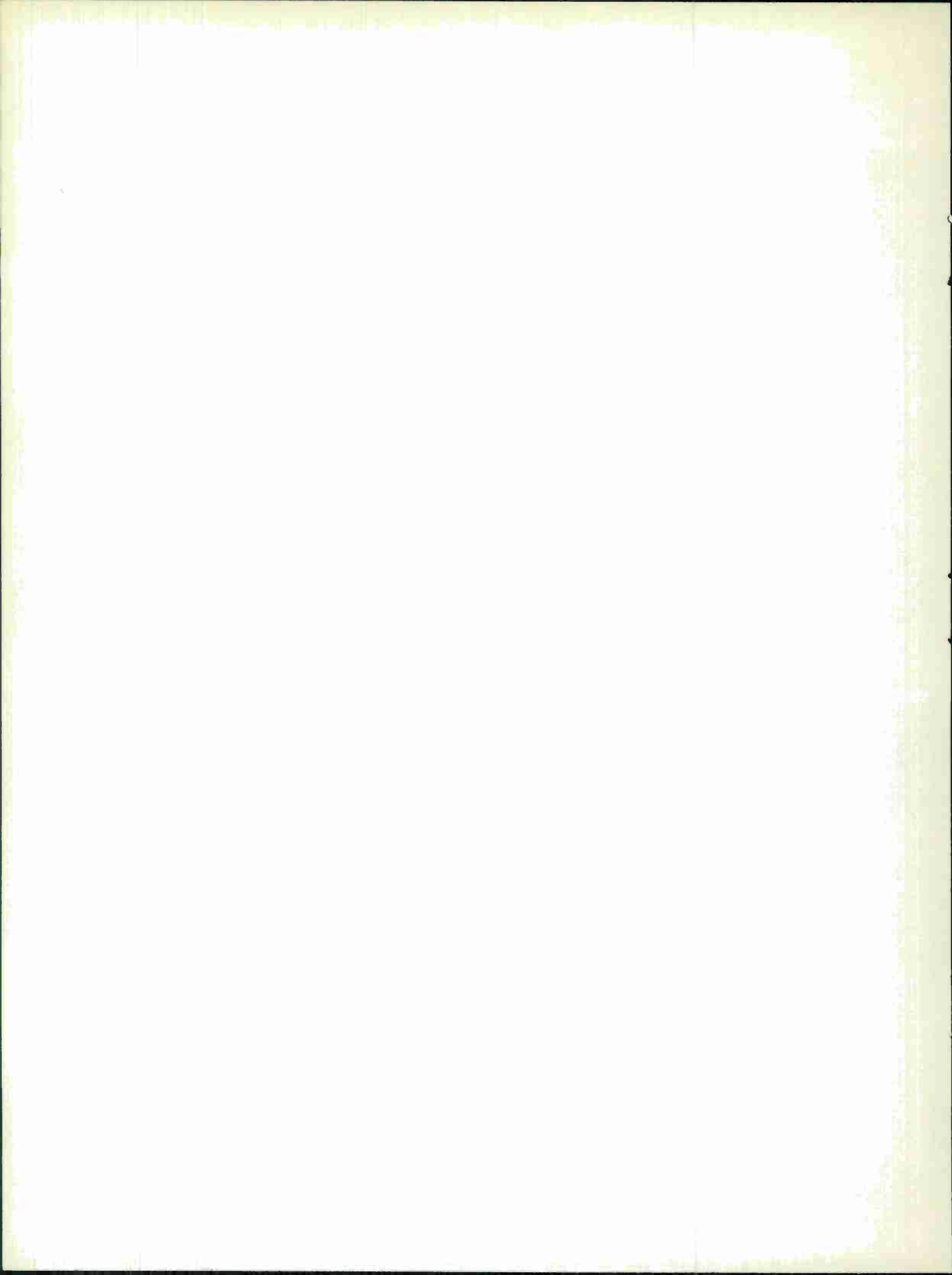
All tricks, except for the obvious ones, have been avoided in coding this program. Tricks have been used at symbolic locations EXIT1 and ADRES1 (nominal locations 17_8 and 236_8 respectively). The tricks are documented in the comments appearing on these cards and on the following REM cards. Several other tricks could have been used, but they cause undue hardship in recoding parts of this program and do not give a big enough reduction in the size of the program to warrant their use.

Several locations have two symbolic names (e.g., PRINTI and PRINTO for 7_8 , REDIN and BUFFER for 312_8), while others, which are not referenced, are assigned symbolic names. The extravagance of assigning two symbolic names to a nominal location allows us to identify somewhat the reason for the reference to that nominal location. For example, a TSX PRINTI, 4 means "go to the closed subroutines that prints out an input card," while a TSX PRINTO, 4 means "go to the closed subroutine that prints out a line of program generated data." These two subroutines are identical although they could be different. Since they are performing different functions (although identically) they are given different symbolic names.

The symbolic locations that are not referenced have been named to show a special property which is explained by the comments accompanying the word.

All I/O performed by the Masked Search Program is by tapes.


G. S. Stoller *gch*



APPENDIX

META

	BAH	MACRO		0003	3
		STL	LCTN	0004	4
		TRA	ERRPRT	0005	5
		END		0006	6
	*		MASKED SEARCH PROGRAM.	0001	1
	*		DO NOT USE RC WORDS IN THIS PROGRAM.	0002	2
		REL	PUNCH A RELOCATABLE BINARY DECK.	0007	7
26	B	SIZE	BSIZE MAY NOT BE LESS THAN 15 BECAUSE	0008	8
		REM	THE INPUT BUFFER STARTS AT THE SAME LOCATION AS	0009	9
		REM	THE OUTPUT BUFFER AND REQUIRES 15 LOCATIONS.	0010	10
25	E	BSIZE	BSIZE-1	0011	11
25	R	BSIZE	BSIZE	0012	12
0		ORG	0	0013	13
0 0 02000 0 00013	S	T	CLRBUF CLEAR THE I/O BUFFER.	0014	14
		EJECT	RESTORE THE PAGE.	0015	15
	*		ROUTINES DEPENDENT ON THE REGULAR MONITOR BEING IN	0016	16
		REM	CORE STORAGE.	0017	17
	*		GET OUT.	0018	18
1 0 07400 4 77252	H	T	S9EMTS,4 ENTER THE SUBROUTINE THAT EMPTIES THE	0019	19
		R	OUTPUT BUFFERS.	0020	20
2 0 02000 0 77777		T	-1 NORMAL RETURN TO MONITOR.	0021	21
	*		ERROR EXIT ROUTINE.	0022	22
3 0 63400 4 00005	E	S	**2,4	0023	23
4 0 07400 4 77252		T	S9EMTS,4 ENTER THE SUBROUTINE THAT EMPTIES THE	0024	24
		R	OUTPUT BUFFERS.	0025	25
5 0 77400 4 00000		A	**4	0026	26
6 0 02000 0 77776		T	-2 ERROR RETURN TO MONITOR.	0027	27
	*		OUTPUT ROUTINES.	0028	28
7	P	S	PRINTU USE THE SAME OUTPUT ROUTINE TO PRINT OUT	0029	29
		R	BOTH THE INPUT CARDS AND THE SEARCHED FOR DATA.	0030	30
7 0 63400 4 00017	P	S	EXIT1,4	0031	31
10 0 07400 4 77246		T	S9PRCS,4 GO TO THE SUBROUTINE THAT PRINTS THE	0032	32
		R	OUTPUT GIVEN TO IT.	0033	33
11 -0 00026 0 00312		M	BUFFER,,BSIZE	0034	34
12 0 00000 0 00000	P	Z	C,0,0 C(*) = +0 .	0035	35
13 0 56000 0 00303	C	L	BLANKS	0036	36
14 0 77400 4 00026		A	BSIZE,4	0037	37
15 -0 60000 4 00340		S	BUFEND,4	0038	38
16 2 00001 4 00015		T	*-1,4,1	0039	39
17 0 77400 4 77760	E	A	1-RDELAY,4 CA(*) = 1-RDELAY INITIALLY ONLY.	0040	40
		R	THIS ALLOWS US TO ENTER THE PART OF THE OUTPUT	0041	41
		R	ROUTINE THAT CLEARS THE OUTPUT BUFFER BEFORE	0042	42
		R	WE DO ANY PRINTING.	0043	43
20 0 02000 4 00001		T	1,4	0044	44
	*		INPUT ROUTINE.	0045	45
21 0 07400 4 77253	R	T	S9REDS,4	0046	46
22 0 00016 0 00313		P	REDIN+1,,14	0047	47
23 0 02000 0 00053		T	BA2 EOF OR REDUNDANCY .	0048	48
		EJECT	RESTORE THE PAGE.	0049	49

			* ROUTINES ENTIRELY INDEPENDENT OF M9C .	0050	50
			* CHECK FOR TYPE OF SPECIFICATION CARD.	0051	51
24	0	774CC 1 C0007	AXT .TYPES=TYPE1,1	0052	52
25	0	754CC 0 C0000	PXA ,0	0053	53
26	0	560CC 0 C0313	LDQ REDIN+1	0054	54
27	-0	763CC 0 C0C14	LGL 6*2	0055	55
30	-0	340CC 1 00272	LAS TYPES,1	0056	56
31	2	0C0C1 1 C0030	TIX *-1,1,1	0057	57
32	2	0C0C1 1 0C055	TIX SETIT,1,1	0058	58
33	2	000C1 1 0C030	TIX *-3,1,1	0059	59
			* THE PRESENT CARD IS NOT A SPECIFICATION CARD.	0C60	60
34	0	602CC 0 00310	SLW KEY HERE, KEY IS BEING USED AS TEMPORARY	0061	61
			REM STORAGE.	0062	62
35	0	322CC 0 00303	ERA BLANKS	0063	63
36	-0	320CC 0 00302	ANA LOCHAR	0064	64
37	0	100CC 0 C0042	TZE ABA1	0065	65
			BAH ERROR IN FORMAT OF INPUT CARD.	0066	66
40	-0	625CC 0 00305	STL LCTN	0004	
41	0	020CC 0 00003	TRA ERRPRT	0005	
			* THE PRESENT CARD IS A COMMENT CARD. COLUMN 1 CONTAINS	0067	67
			ABA1 A CARRIAGE CONTROL CHARACTER FOR THE OUTPUT LISTING.	0068	68
42	-0	500CC 0 00303	CAL BLANKS	0069	69
43	-0	765CC 0 C0014	LGR 6*2	0070	70
44	-0	600CC 0 00313	STQ REDIN+1	0071	71
45	0	560CC 0 00303	LDQ BLANKS	0072	72
46	-0	500CC 0 C0310	CAL KEY	0073	73
47	-0	765CC 0 00014	LGR 6*2	0074	74
50	-0	600CC 0 00312	STQ REDIN	0075	75
51	0	074CC 4 00007	TSX PRINT1,4	0076	76
52	0	020CC 0 C0021	TRA RDELAY	0077	77
			BA2 EOF OR REDUNDANCY FROM COMIN .	0078	78
53	-0	625CC 0 00305	STL LCTN	0004	
54	0	020CC 0 C0003	TRA ERRPRT	0005	
			* THE PRESENT CARD IS A SPECIFICATION CARD.	0079	79
55	0	767CC 0 00014	SETIT 6*2 POSITION TYPE SPECIFICATION CHARACTERS	0080	80
			REM FOR PRINTING.	0081	81
56	-0	501CC 0 C0274	ORA CARRAG BRING IN BLANKS AND THE CARRIAGE	0082	82
			REM CONTROL CHARACTER.	0083	83
57	0	602CC 0 C0312	SLW REDIN STORE FOR PRINTING.	0084	84
60	-0	765CC 0 00014	LGR 6*2	0085	85
61	-0	600CC 0 C0313	STQ REDIN+1	0086	86
62	-0	500CC 0 00315	CAL REDIN+3	0087	87
63	0	074CC 4 00223	TSX 8T02,4	0088	88
64	-0	500CC 0 C0314	CAL REDIN+2	0089	89
65	0	074CC 4 00223	TSX 8T02,4	0090	90
66	-0	500CC 0 C0313	CAL REDIN+1	0091	91
67	0	074CC 4 00237	TSX SIGN,4	0092	92
70	-0	600CC 0 C0310	STQ KEY	0093	93
71	-0	500CC 0 00320	CAL REDIN+6	0094	94
72	0	074CC 4 00223	TSX 8T02,4	0095	95
73	-0	500CC 0 00317	CAL REDIN+5	0096	96
74	0	074CC 4 00223	TSX 8T02,4	0097	97

75	-0	50000	0	00316	CAL	REDIN+4	0098	98
76	0	07400	4	00237	TSX	SIGN+4	0099	99
77	-0	60000	0	00311	STC	KEY+1	0100	100
100	0	07400	4	00007	TSX	PRINT1,4	0101	101
101	0	02000	1	00110	TRA	NDWGO,1	0102	102
						TRANSFER TABLE. THIS IS TIED TO THE TYPES TABLE.	0103	103
102	0	02000	0	00123	TRA	EQ	0104	104
103	0	02000	0	00143	TRA	RL	0105	105
104	0	02000	0	00146	TRA	RA	0106	106
105	0	02000	0	00113	TRA	BD	0107	107
106	0	02000	0	00110	TRA	MK	0108	108
107	0	02000	0	00001	TRA	HU	0109	109
				110	NDWGO	SYN	0110	110
						ORTAIN MASK.	0111	111
110	-0	50000	0	00310	MK	CAL	0112	112
111	0	60200	0	00307		SLW	0113	113
112	0	02000	0	00021	TRA	RDELAY	0114	114
						SET BOUNDARIES FOR SEARCH.	0115	115
113	-0	50000	0	00311	BD	CAL	0116	116
114	0	62100	0	00306		STA	0117	117
115	0	62100	0	00126		STA	0118	118
116	0	40100	0	00236	ADM	ADRES1	0119	119
117	0	62100	0	00200	STA	SETR	0120	120
120	-0	40000	0	00310	SBM	KEY	0121	121
121	0	62100	0	00124	STA	INDEX	0122	122
122	0	02000	0	00021	TRA	RDELAY	0123	123
						LOOK FOR EQUALS.	0124	124
123	0	77400	2	00025	EQ	AXT	0125	125
				124	RGEQ	SYN	0126	126
						ENTRY POINT TO EQ ROUTINE WHEN A	0127	127
						RANGE-SEARCH ROUTINE FINDS THAT BOTH ARGUMENTS	0128	128
						ARE IDENTICAL WHEN LOOKED AT THROUGH THE MASK.	0129	129
124	0	77400	1	77777	INDEX	AXT	0130	130
						CA(*) = -1 INITIALLY. THIS ADDRESS WILL	0131	131
						BE SET BY BD SPECIFICATION CARDS.	0132	132
125	1	77777	1	00126		TXI	0133	133
126	-0	50000	1	77776	SETE	CAL	0134	134
						CA(*) = -2 INITIALLY. THIS ADDRESS WILL	0135	135
						BE SET BY BD SPECIFICATION CARDS.	0136	136
127	0	32200	0	00310		ERA	0137	137
130	-0	32000	0	00307		ANA	0138	138
131	0	10000	0	00136		TZE	0139	139
132	2	00001	1	00126		TIX	0140	140
133	3	00024	2	00021		TXH	0141	141
134	0	07400	4	00007	EQLPR	TSX	0142	142
135	0	02000	0	00021		TRA	0143	143
136	0	07400	4	00245	FOUNDE	TSX	0144	144
137	-2	00001	1	00134		TNX	0145	145
140	2	00001	2	00126		TIX	0146	146
141	0	07400	4	00007		TSX	0147	147
142	1	00024	2	00126		TXI	0148	148
						SET,2,ERSIZE-1	0149	149
						LOOK FOR RANGE (LOGICAL).	0150	150
143	0	56000	0	00275	RL	LDQ		
144	-0	50000	0	00276		CAL		
145	0	02000	0	00150		TRA		
						XCHLGL		
						R		
						LOOK FOR RANGE (ALGEBRAIC).		

146	0	56000	0	00277	RA	LDQ	ALGCMF	IC(ALGCMF) = (CAS **).	0151	151
147	-0	50000	0	00300		CAL	XCHALG	IC(XCHALG) = (XCA).	0152	152
						REM		DROP THROUGH TO R ROUTINE.	0153	153
					*		LOOK FOR RANGE.		0154	154
150	0	60200	0	00203	R	SLW	XCH		0155	155
151	-0	62000	0	00165		SLQ	COMPR		0156	156
152	-0	62000	0	00204		SLQ	COMPA1		0157	157
153	-0	62000	0	00213		SLQ	COMPA2		0158	158
154	-0	50000	0	00307	RG	CAL	MASK	ENTRY POINT OF RANGE-SEARCH ROUTINE WERE WE TO HAVE ONLY ONE POSSIBLE RANGE-SEARCH.	0159	159
						REM			0160	160
155	0	32000	0	00311		ANS	KEY+1		0161	161
156	-0	32000	0	00310		ANA	KEY		0162	162
157	0	60200	0	00310		SLW	KEY		0163	163
160	-0	13000	0	00000		XCL			0164	164
161	0	52200	0	00203		XEC	XCH		0165	165
162	0	77400	2	00025		AXT	RBSIZE,2		0166	166
163	0	53400	1	00124		LXA	INDEX,1		0167	167
164	-0	77400	4	00000		AXC	0,4		0168	168
165	0	34000	0	00311	COMPR	CAS	KEY+1	THE OPERATION TO BE PERFORMED HERE IS	0169	169
						REM		EITHER CAS OR LAS. THIS OPERATION IS SET	0170	170
						REM		BY RL AND RA SPECIFICATION CARDS.	0171	171
166	1	77777	4	00170		TXI	**2,4,-1	GR(C(KEY),C(KEY+1)) = 1.	0172	172
167	1	77776	2	00174		TXI	RGEQ,2,(EHSIZE-2)-RBSIZE	EQ(C(KEY),C(KEY+1)) = 1.	0173	173
						REM		DROP THROUGH IF LS(C(KEY),C(KEY+1)) = 1.	0174	174
170	-0	50000	4	00271		CAL	ADRESS,4		0175	175
171	0	62100	0	00207		STA	COMPA1+3		0176	176
172	0	77100	0	00022		ARS	18		0177	177
173	0	62100	0	00214		STA	COMPA2+1		0178	178
174	-0	50000	4	00272		CAL	ADRESS+1,4		0179	179
175	0	62100	0	00205		STA	COMPA1+1		0180	180
176	0	77100	0	00022		ARS	18		0181	181
177	0	62100	0	00216		STA	COMPA2+3		0182	182
200	-0	50000	1	77777	SETR	CAL	-1,1	CA(*) = -1 INITIALLY. THIS ADDRESS WILL	0183	183
						REM		BE SET BY BD SPECIFICATION CARDS.	0184	184
201	-0	32000	0	00307		ANA	MASK		0185	185
202	-0	13000	0	00000		XCL			0186	186
203	0	13100	0	00000	XCH	XCA		THE OPERATION TO BE PERFORMED HERE IS	0187	187
						REM		EITHER XCA OR XCL. THIS OPERATION IS SET	0188	188
						REM		BY RL AND RA SPECIFICATION CARDS.	0189	189
204	0	34000	0	00310	COMPA1	CAS	KEY	THE OPERATION TO BE PERFORMED HERE IS	0190	190
						REM		EITHER CAS OR LAS. THIS OPERATION IS SET	0191	191
						REM		BY RL AND RA SPECIFICATION CARDS.	0192	192
205	2	00001	1	00000		TXI	**1,1		0193	193
206	2	00001	1	00217		TXI	FOUNDR,1,1		0194	194
207	2	00001	1	00000		TXI	**1,1		0195	195
210	3	00024	2	00021		TXH	RDELAY,2,RBSIZE-1		0196	196
211	0	07400	4	00007		TSX	PRINTO,4		0197	197
212	0	02000	0	00021		TRA	RDELAY		0198	198
213	0	34000	0	00311	COMPA2	CAS	KEY+1	THE OPERATION TO BE PERFORMED HERE IS	0199	199
						REM		EITHER CAS OR LAS. THIS OPERATION IS SET	0200	200
						REM		BY RL AND RA SPECIFICATION CARDS.	0201	201

214 0 020CC 0 00006
 215 0 020CC 0 00217
 216 0 020CC 0 00000
 217 0 074CC 4 00245
 220 2 000C1 2 00200
 221 0 074CC 4 00007
 222 1 00024 2 00200

FOUNDR TRA **
 TRA FOUNDR
 TRA **
 TSX 2T08,4
 TIX SETR,2,1
 TSX PRINTU,4
 TXI SETR,2,RBSIZE-1

0202 202
 0203 203
 0204 204
 0205 205
 0206 206
 0207 207
 0208 208

223 -0 765CC 0 00003
 224 0 771CC 0 00003
 225 -0 765CC 0 00003
 226 0 771CC 0 00003
 227 -0 765CC 0 00003
 230 0 771CC 0 00003
 231 -0 765CC 0 00003
 232 0 771CC 0 00003
 233 -0 765CC 0 00003
 234 0 771CC 0 00003
 235 -0 765CC 0 00003

8T02 LGR 3
 DUP 2,5
 ARS 3
 LGR 3
 ARS 3
 LGR 3
 ARS 3
 LGR 3
 ARS 3
 LGR 3
 ARS 3
 LGR 3
 ARS 3
 LGR 3

0209 209
 0210 210
 0211 211
 0212 212
 0213 213
 0214 214
 0213
 0214
 0213
 0214
 0213
 0214
 0213
 0214

236 0 020CC 4 00001
 237 0 322CC 0 00301
 240 -0 320CC 0 00302
 241 -0 106CC 4 00001
 242 -0 760CC 0 00003
 243 0 765CC 0 00000
 244 0 020CC 4 00001

ADRES1 SYN *
 REM
 TRA 1,4
 SIGN ERA MINUS
 ANA LUCHAR
 TNZ 1,4
 SSM
 LRS 0
 TRA 1,4

CA(*) MUST BE 1 , OTHERWISE CHANGE
 ADRES1 .

0215 215
 0216 216
 0217 217
 0218 218
 0219 219
 0220 220
 0221 221
 0222 222
 0223 223

245 0 754CC 1 00000
 246 -0 400CC 0 00306
 247 -0 765CC 0 00003
 250 0 767CC 0 00003
 251 -0 765CC 0 00006
 252 0 767CC 0 00003
 253 -0 765CC 0 00006
 254 0 767CC 0 00003
 255 -0 765CC 0 00006
 256 0 767CC 0 00003
 257 -0 501CC 0 00304
 260 -0 765CC 0 00017
 261 -0 600CC 2 00340
 262 0 020CC 4 00001

2T08 REM
 REM
 PXA ,1
 SBM UB
 LGR 3
 ALS 3
 LGR 6
 ALS 3
 LGR 6
 ALS 3
 LGR 6
 ALS 3
 ORA L9BLMK
 LGR 3+6+6
 STQ BUFEND,2
 TRA 1,4

TABLE OF IDENTIFYING CHARACTERS ON SPECIFICATION CARDS.
 THIS IS TIED TO THE NOWGO TRANSFER TABLE.

0224 224
 0225 225
 0226 226
 0227 227
 0228 228
 0229 229
 0230 230
 0231 231
 0232 232
 0233 233
 0234 234
 0235 235
 0236 236
 0237 237
 0238 238
 0239 239
 0240 240

263 -3 300CC 0 00025
 264 -3 300CC 0 00051
 265 -3 30000 0 00051

TYPE1 REM
 BCD 1,00000
 BCD 1,0000RL
 BCD 1,0000RA

0241 241
 0242 242
 0243 243
 0244 244
 0245 245

266	-3	30000	0	00022	BCD	1,0000BD		0246	246
267	-3	30000	0	00044	BCD	1,0000MK		0247	247
270	-3	30000	0	00030	BCD	1,0000HU		0248	248
				272	SYN	++1		0249	249
					TABLE OF ADDRESSES USED BY THE R ROUTINE.			0250	250
271	0	00200	0	00200	PZE	SETR,,SETR		0251	251
272	0	00217	0	00213	PZE	COMPA2,,FOUNDR		0252	252
273	0	00200	0	00200	PZE	SETR,,SETR		0253	253
					CONSTANTS			0254	254
274	-3	34260	0	00060	CARRAG	BCD	1,K CO		
275	-0	34000	0	00000	LGLCMP	LAS	**	0255	255
276	-0	13000	0	00000	XCHLGL	XCL	USED FOR RL SEARCH.	0256	256
277	0	34000	0	00000	ALGCMF	CAS	**	0257	257
300	0	13100	0	00000	XCHALG	XCA	USED FOR RA SEARCH.	0258	258
301	-3	30000	0	00000	MINUS	BCD	1,00000-	0259	259
302	0	00000	0	00077	LOCHAR	OCT	77	0260	260
303	-3	36060	6	06060	BLANKS	BCD	1,	0261	261
304	0	00000	0	60000	L9BLNK	OCT	60000	0262	262
					THIS LOCATION CONTAINS THE HOLLERITH CODE			0263	263
					FOR A BLANK, SHIFTED LEFT 9 BIT POSITIONS			0264	264
					(3/2 COLUMNS).			0265	265
					STORAGE.			0266	266
305	0	00000	0	00000	LCTN	PZE	**	0267	267
306	0	00000	0	77776	UB	PZE	-2	0268	268
					ERROR FINDING AID.			0269	269
					CA(*) = -2 INITIALLY. THIS ADDRESS WILL			0270	270
307	-3	77777	7	77777	MASK	OCT	7777777777	0271	271
					BE SET BY BD SPECIFICATION CARDS.			0272	272
					INITIAL SETTING. THIS LOCATION WILL BE			0273	273
					SET BY MK SPECIFICATION CARDS.			0274	274
310			2		KEY	BSS	2	0275	275
			312		REDIN	SYN	BUFFER	0276	276
					THE INPUT BUFFER IS IDENTICAL IN STARTING			0277	277
					LOCATION TO THE OUTPUT BUFFER.				
312			26		BUFFER	BSS	B SIZE		
			340		BUFEND	SYN	BUFFER+B SIZE		
			0		END		START		

THE FOLLOWING SYMBOLS APPEAR TO BE CORRECT

\$2TOR=	165/000245	\$8T02=	147/000223	\$R=	104/000150	\$BD=	75/000113
\$EC=	83/000123	\$HO=	1/000001	\$MK=	72/000110	\$RA=	102/000146
\$RG=	108/000154	\$RL=	99/000143	\$UB=	198/000306	\$BA2=	43/000053
\$KEY=	200/000310	\$XCH=	131/000203	\$ABA1=	34/000042	\$LCTN=	197/000305
\$MASK=	199/000307	\$RG0Q=	84/000124	\$SETE=	86/000126	\$SETR=	128/000200
\$SIGN=	159/000237	\$R SIZE=	22/000026	\$COMPR=	117/000165	\$EQLPR=	92/000134
\$EXIT1=	15/000017	\$INDEX=	84/000124	\$MINUS=	193/000301	\$NOWGO=	72/000110
\$PZERC=	10/000012	\$REDIN=	202/000312	\$SETIT=	45/000055	\$START=	0/000000
\$TYPE1=	179/000263	\$TYPES=	186/000272	*****\$ADRES1=	158/000236	*****\$ADDRESS=	185/000271
*****\$ALGCMF=	191/000277	*****\$BLANKS=	195/000303	*****\$BUFEND=	224/000340	*****\$BUFFER=	202/000312
*****\$CARRAG=	188/000274	*****\$CLRBUF=	11/000013	*****\$COMPA1=	132/000204	*****\$COMPA2=	139/000213
*****\$E+SIZE=	21/000025	*****\$ERRPRT=	3/000003	*****\$FOUNDE=	94/000136	*****\$FOUNDR=	143/000217
*****\$L9BLNK=	176/000304	*****\$LGLCMP=	189/000275	*****\$LCCHAR=	194/000302	*****\$PRINTI=	7/000007
*****\$PRINTC=	7/000007	*****\$RBSIZE=	21/000025	*****\$RDELAY=	17/000021	*****\$XCHALG=	192/000300
*****\$XCHLGL=	190/000276						

THE FOLLOWING SYMBOLS FROM THE COMPOOL WERE USED BY THE PROGRAM

*****\$S9EMTS= 32426/077252 *****\$S9PRCS= 32422/077246 *****\$S9REDS= 32427/077253

THE FOLLOWING MACROS HAVE BEEN DEFINED BY THE PROGRAM

BAH

END OF META ASSEMBLIES.

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(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) The MITRE Corporation Bedford, Massachusetts		2a. REPORT SECURITY CLASSIFICATION Unclassified	
		2b. GROUP N/A	
3. REPORT TITLE Masked Search Program			
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c.			
d.			
10. AVAILABILITY/LIMITATION NOTICES Qualified requestors may obtain from DDC DDC release to OTS authorized			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Directorate of Computers, Electronic Systems Division, L. G. Hanscom Field, Bedford, Massachusetts	
13. ABSTRACT The Masked Search Program is a static trace and can be used for debugging or modifying a 7090 program. This report describes the program and how it is used in most cases. Additional information is provided to cover unusual occurrences during the program run.			

14.	KEY WORDS	LINK A		LINK B		LINK C	
		ROLE	WT	ROLE	WT	ROLE	WT
Programming (computers)							

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